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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/019,278	01/02/2002	Marc Delaunay	217218US2PCT	7791
22850	7590	10/21/2003		
OBLON, SPIVAK, MCCLELLAND, MAIER & NEUSTADT, P.C. 1940 DUKE STREET ALEXANDRIA, VA 22314				
			EXAMINER MARKHAM, WESLEY D	
			ART UNIT 1762	PAPER NUMBER

DATE MAILED: 10/21/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/019,278

Applicant(s)

DELAUNAY ET AL.

Examiner

Wesley D Markham

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 July 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 27-56 is/are pending in the application.
- 4a) Of the above claim(s) 41-56 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 27-40 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 02 January 2002 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☒ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other: _____

DETAILED ACTION

Response to Amendment

1. Acknowledgement is made of applicant's preliminary amendment A, filed as paper #4 on 1/2/2002, in which a substitute abstract of the disclosure was submitted, Claims 1 – 26 were canceled without prejudice or disclaimer, and Claims 27 – 56 were added. Claims 27 – 56 are currently pending in U.S. Application Serial No. 10/019,278, which is a 371 (i.e., National Stage) Application of PCT/FR00/01827, filed on 6/29/2000.

Election/Restrictions

2. Applicant's election with traverse of Group I, Claims 27 – 40, drawn to a process for depositing, by electron cyclotron resonance (ECR) plasma, a web of carbon nanofibers or nanotubes onto a substrate without any catalyst, in Paper No. 6 is acknowledged. The traversal is on the ground(s) that there is no consideration in the outstanding Office Action (i.e., the restriction requirement, paper #5, mailed on 5/22/2003) as to the contribution to which the special technical feature in each of the claimed inventions makes over the prior art when considered as a whole – thus, there is no basis upon which to conclude that the identified special technical feature in each of the claimed inventions, *when considered as a whole*, does not make a contribution over the prior art. This traversal is not found persuasive because of the following reasons. After carefully reviewing the claims of the instant application, the examiner notes that the only "special technical feature" that is shared between all of

the three groups of claims (i.e., the process claims, the device claims, and the product claims) is that the substrate / carbon nanotube film is free from any catalyst. In the context of the claims of the instant application, this shared special technical feature does not provide a contribution over the prior art (see USPN 6,346,303, which teaches carbon nanotubes grown by ECR-CVD without a catalyst, and USPN 6,099,965, which teaches pure, entangled carbon nanotube mats that have a carbon purity greater than 99 wt % (i.e., are free of catalysts)). In other words, the only shared "special technical feature" between the claims of the instant application does not make a contribution over the prior art, even when the claimed inventions are considered as a whole. The applicant's claimed inventions have been considered as a whole, to the extent that the "special technical feature" shared by all three groups of claims has been considered in the context of the claimed inventions, as a whole. The requirement is still deemed proper and is therefore made FINAL, and as such, Claims 41 – 56 are withdrawn from further consideration by the examiner as being drawn to a non-elected invention.

Priority

3. Acknowledgment is made of applicant's claim for foreign priority based on an application filed in France on 7/1/1999 (i.e., FR 99/08473). It is noted, however, that a copy of the certified copy of the priority document has not been received in this National Stage Application from the International Bureau (PCT Rule 17.2(a)).

Information Disclosure Statement

4. The information disclosure statement (IDS) filed as paper #2 on 1/2/2002 fails to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each U.S. and foreign patent; each publication or that portion which caused it to be listed; and all other information or that portion which caused it to be listed. The IDS has been placed in the application file, but the information referred to therein has not been considered.
5. Acknowledgement is made of the IDS submitted by the applicant on 3/26/2002. Please note that this IDS lists the same references that were listed on the IDS filed as paper #2 on 1/2/2002, as well as providing copies of the aforementioned references as required by 37 CFR 1.98(a)(2). Therefore, the references listed thereon have been considered by the examiner as indicated on the attached copy of the PTO-1449 form.

Drawings

6. The formal drawings (4 sheets, 7 figures) filed by the applicant on 1/2/2002 are approved by the examiner.

Specification

7. The lengthy specification (28 pages, exclusive of the claims) has not been checked to the extent necessary to determine the presence of all possible minor errors.

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Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

8. Additionally, while the specification of the instant application contains a heading for the "Brief description of the drawings" section, the specification lacks other section headings such as "Background of the invention", "Summary of the invention", and "Detailed description of the invention". The applicant is suggested to amend the specification to include these headings in order to conform to conventional U.S. patent practice.
9. The disclosure is objected to because of the following informalities: The specification of the instant application makes reference to documents (15), (16), (17), (18), (19), and (20) at the following locations: page 3, lines 14, 17, and 24; page 4, lines 9 and 21; page 5, lines 1, 13, 15, and 20; page 8, line 11; and page 13, line 8. However, no description of documents (15), (16), (17), (18), (19), and/or (20) (i.e., the title, author, publication date, journal, etc.) is provided in the specification. Therefore, the references to the aforementioned documents in the specification of the instant application do not make sense, and it is unclear to what "documents" the applicant is referring. Appropriate correction is required.

Claim Objections

10. Claims 28 and 29 are objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the

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claim(s) in proper dependent form, or rewrite the claim(s) in independent form.

Specifically, Claim 28, which depends from Claim 27 and from which Claim 29 depends, requires a pressure “less than or equal to 10^{-4} mbar” (see line 3 of the claim). However, Claim 27 requires a pressure “less than 10^{-4} mbar” (see line 6 of the claim). Therefore, Claims 28 and 29 include a pressure value (i.e., a pressure of exactly 10^{-4} mbar) that is explicitly excluded from Claim 27, and for this reason, Claims 28 and 29 fail to further limit Claim 27.

11. Claims 27 and 36 are objected to because of the following informalities:

- Claim 27: The phrase, “a web of carbons nanofibers or nanotubes...” in lines 1 – 2 of the claim appears to contain a typographical error (i.e., the word “carbon” appears to be misspelled “carbons”).
- Claim 36: The phrase, “in which the gas containing gas is chosen from methane,...” in lines 1 – 2 of the claim appears to contain a typographical error. It appears as though the aforementioned phrase should read, “in which the gas containing carbon is chosen from methane,...” in order to correspond to Claim 27, from which Claim 36 depends.

Appropriate correction is required.

Claim Observations

12. The examiner notes that the term “graphite type carbon” in Claim 30 is sufficiently definite because it is clear that “graphite type carbon”, as required by the applicant,

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must simply have a minority proportion of sp³ bonds and a majority proportion of sp² bonds (see Claim 30).

13. Further, Claims 39 and 40 recite the limitations that, "the substrate is positively polarized, preferably from +20 volts to +100 volts" and, "the plasma is negatively polarized, preferably from -20 to -100 volts", respectively. For the purposes of examination, the examiner has interpreted Claims 39 and 40 to require that the substrate be positively polarized and the plasma be negatively polarized, respectively, without requiring the preferable polarization voltage ranges. In other words, the preferable voltage ranges recited in Claims 39 and 40 have been interpreted as being descriptive, not limiting.

Claim Rejections - 35 USC § 112

14. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

15. Claims 27 – 40 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

16. Specifically, independent Claim 27 (from which Claims 28 – 40 depend) requires inducing at least one of ionization and dissociation of a gas containing carbon in a "highly unbalanced magnetic mirror" in a center of a deposition chamber, thus producing species that deposit on a heated substrate. The term "highly unbalanced

magnetic mirror" is a relative term that renders the claims indefinite. The term is not defined by the claim and does not appear to have an "art-recognized" definition, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the claimed invention. For example, what degree of unbalancing in the magnetic fields / mirror constitutes a "highly unbalanced magnetic mirror"? What is the cutoff between a "balanced magnetic mirror", an "unbalanced magnetic mirror", and/or a "highly unbalanced magnetic mirror"? Since one skilled in the art would not reasonably recognize the boundaries encompassed by the limitation, "highly unbalanced magnetic mirror", the scope of the claims is vague, and the claims are indefinite under 35 U.S.C. 112, second paragraph.

17. In addition, Claim 29 (which depends from Claim 28) requires that "the steps are carried out simultaneously". This limitation renders Claim 29 vague and indefinite because it is unclear which steps of Claim 28 must be carried out simultaneously. In other words, does Claim 29 require that all the steps of Claim 28 be carried out simultaneously or only some of the steps be carried out simultaneously? If only some of the steps are required to be carried out simultaneously, which ones of the steps? As such, the scope of Claim 29 is unclear, and the claim is indefinite under 35 U.S.C. 112, second paragraph.

18. Further, Claims 39 and 40 require that "the plasma is connected to a frame" and "the substrate is connected to a frame", respectively. After carefully reviewing the applicant's specification, it is unclear what the applicant intends to claim by reciting

that the plasma / substrate is connected to a frame. Specifically, how is the plasma / substrate "connected to a frame"? (i.e., is it physically connected, electrically connected, etc.)? Is the "frame" a physical element that is located on or in the deposition chamber, or is it a hypothetical state that is used as a reference to "ground potential" when compared to the positively charged substrate or negatively charged plasma? Since it is unclear what the applicant intends to claim by reciting that the plasma / substrate is connected to a frame, the scope of Claims 39 and 40 is unclear, and the claims are indefinite under 35 U.S.C. 112, second paragraph.

Allowable Subject Matter

19. Claims 27 – 40 are rejected under 35 U.S.C. 112, second paragraph, for the reasons set forth above in paragraphs 15 – 18, but no prior art has been applied against the claims.
20. The following is a statement regarding why no prior art has been applied against Claims 27 – 40 of the instant application.
21. Independent Claim 27 (from which Claims 28 – 40 depend) is drawn to a process for depositing, by ECR plasma, a web of carbon nanofibers or nanotubes on a substrate without any catalyst. In this process, microwave power is injected into a deposition chamber comprising a highly unbalanced magnetic mirror and at least one ECR zone within the interior of the deposition chamber itself and opposite the substrate. Under a pressure of less than 10^{-4} mbar, a gas containing carbon is ionized and/or

dissociated in the magnetic mirror in a center of the deposition chamber, thus producing species that deposit on the substrate, which is heated, to form the web.

22. Shih et al. (USPN 6,346,303 B1) teaches a method of depositing aligned carbon nanotubes by ECR plasma CVD within the pores (i.e., parallel aligned channels) of a host material. The pores serve as a template so that the carbon precursor plasma deposits as nanotubes on the walls of the pores. The process of Shih et al. does not appear to require any catalyst. However, Shih et al. does not teach or reasonably suggest using a "highly unbalanced magnetic mirror" to perform the ECR CVD process, as required by the applicant's claims. Additionally, the carbon nanotubes of Shih et al. are deposited on the walls of the parallel aligned channels of the substrate and therefore form an array of aligned carbon nanotubes, not a web of carbon nanofibers or nanotubes, as required by the applicant's claims. Yang et al. (USPN 6,420,092 B1) teaches that carbon nanotubes can be deposited by ECR CVD but does not teach or reasonably suggest the specifics of the process (i.e., the deposition of a web of carbon nanofibers / nanotubes, the use of a substrate without any catalyst, the highly unbalanced magnetic mirror, etc.) claimed by the applicant. Tennent et al. (USPN 6,099,965), Lavin et al. (USPN 6,426,134 B1), and Smalley et al. (WO 98/39250 A1) all teach pure interconnected carbon nanotube webs, the webs being free of a catalyst, but the webs are not produced by a catalyst-free ECR CVD process, as claimed by the applicant. Mochizuki et al. (USPN 5,433,788), Hirose et al. (USPN 5,685,913), Dandl (USPN 5,370,765), and Delaunay et al. (USPN 4,638,216) all appear to teach "unbalanced magnetic mirror" ECR plasma

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apparatuses, but none of the references teaches or reasonably suggests performing the applicant's claimed carbon nanotube / nanofiber web deposition process with the apparatus(es).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Wesley D Markham whose telephone number is (703) 308-7557. The examiner can normally be reached on Monday - Friday, 8:00 AM to 4:30 PM.

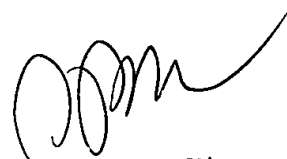
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shrive Beck can be reached on (703) 308-2333. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.



WDM

Wesley D Markham
Examiner
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